## Remarks/Arguments

Applicant respectfully requests that Examiner reconsider the application in view of the above amendments and the remarks set forth below.

**Election/Restriction**

Applicant confirms the provisional election, with traverse, to prosecute the invention of Group I, claims 1-12.

**Specification**

Examiner in the Office Action of October 5, 2004, objected to the disclosure because of certain informalities. The following amendments address Examiner's objection.

Page 3, line 21 the word "Xenon" is amended to -- xenon --.

Page 4, line 4, the word "3HE" is amended to -- 3He --.

Page 16, lines 21-22, the reference character 36 is amended so that the specification reads "from the entrance opening 36a to the exit opening 36b..." No new matter is added as FIG. 4 shows the flowing mixture of gas flow in direction 54 (specification, page 13, lines 3-4), which requires the opening now marked 36a to be the entrance opening and the opening now marked 36b to be the exit opening.

By Preliminary Amendment dated February 4, 2003, the paragraph entitled "Government Sponsorship" was erroneously added. This paragraph has been removed.

Examiner requested Applicant's cooperation in correcting any errors in the specification. Applicant hereby submits a substitute specification in response. The corrections, as shown on the marked version begin on page 3 of this paper.

The corrections to the specification include primarily grammatical and stylistic corrections and express references to the figures for ease of understanding. Other corrections are discussed below at the locations at which the correction is first made.

Page 7, line 5, paragraph beginning —"The invention method 10..." corrections are made to make the text match more closely the wording of the referenced drawings.

Page 8, line 1, paragraph beginning – "Another narrower embodiment..." through page 9, line 2 – Corrections are made to describe reference character 40 as – laser light – and to move these paragraphs to the page 18, line 14 through page 19, line 17.

Page 9, line 3, paragraph beginning – "Another narrower embodiment..." through page 9, line 8. These paragraphs are deleted as unnecessary.

Page 9, line 9, paragraph beginning – "The present invention..." through page 9, line 18. The specification is amended to reference "an entrance 36a and an exit 36b" instead of "two openings, 36". No new matter is added as FIG. 4 shows the flowing mixture of gas flow in direction 54 (specification, page 13, lines 3-4,), which requires the opening now described as 36a to be the entrance opening and the opening now marked 36b to be the exit opening.

Page 1, line 13, paragraph beginning – "In contrast to existing...." Corrections are made to describe reference character 52 consistently as "flowing mixture of gas 52."

Page 17, line 1, paragraph beginning – "The openings...." Corrections are made to refer consistently to "transparent window 38."

Page 18, line 1 -- Corrections are made to refer to "the unextended portion 72, "which is shown on FIG. 5.

**Drawings**

FIG. 1 is corrected, as shown, so that the wording of the steps matches more closely the wording of the specification. (specification, page 7, line 5, paragraph beginning – "The present invention...") The order of the steps is revised so that they appear in numerical order although the steps can be initiated in any order (specification, page 7, lines 11-12).

FIG. 2 is corrected to refer to embodiment "10a" to distinguish the embodiment from that shown in FIG. 1. Corrections are made to the wording of the steps so that they match more closely the wording of similar steps in FIG. 1 and the wording of the specification. The order of the steps is revised so that they appear in numerical order although the steps can be initiated in any order.

FIGS. 3-6 are corrected as shown an "entrance 36a" and an "exit 36b" instead of two openings 36. No new matter is added as FIG. 4 shows the flowing mixture of gas flow in

direction 54 (specification, page 13, line 3-4) which requires the opening now referred to as 36a to be the entrance opening and the opening now referred to as 36b to be the exit opening.

**Disposition of Claims**

Claims 1-6, 11 and 12 are rejected. Claims 7-10 are objected to. Claims 13-22 are withdrawn. Claims 1-12 remain pending.

**Claim Objections**

Claims 7, 9 and 10 are objected to because of the informality in claim 7 of the incorrectly spelled word "propogated." Claim 7 is amended to correct the spelling.

**Rejections under 35 U.S.C. §112**

Claims 2 and 5 are rejected as being indefinite. Claims 2 and 5 are amended, as shown in the Listing of Claims, to make them definite.

**Rejections under 35 U.S.C. §102**

Claims 1, 4 and 6 are rejected as being anticipated by Ryan et al. (U.S. 5,934,103) ("Ryan"). Applicant respectfully traverses the rejections.

Specifically, Examiner in the Office Action of October 5, 2004 states that Ryan teaches a polarizing process comprising:

> "(a) moving a flowing mixture of gas, at least containing a polarizable nuclear species 40 (=xenon) and vapor of an alkali metal 36a (=Rb gas), with a transport velocity that is not negligible when compared with a natural velocity of diffusive transport (inherent);....
>
> The transport velocity of the flowing gas is substantially greater than the natural velocity of diffusive transport (=up-welling of gases) [col. 4, lines 6-13).
>
> The magnetic field 32 is uniform and substantially aligned with the direction of laser light propagation (Fig. 2)." (Office Action, page 6, lines 1-13).

The Office Action misreads Ryan in a number of material respects. First, the magnetic field 32 in Ryan is not "...substantially aligned with the direction of laser light propagation (Fig. 2)." Fig. 2 in Ryan shows a magnetic field 32 transverse to the direction of laser light propagation 48. As a result, the method described in Ryan is incapable of developing polarization. The present invention cannot, therefor, be anticipated by Ryan.

Second, the Office Action misreads Ryan in alleging that Ryan describes, or even suggests, a flowing mixture of gas "with a transport velocity that is not negligible when compared with a natural velocity of diffusive transport." The Office Action's allegation that such greater velocity is implied by the description in Ryan of the gases as "up-welling" (Col. 4, lines 6-13) is unfounded. The word "up-welling" does not imply any velocity. It only implies a direction (as discussed in more detail below).

There is no suggestion in Ryan of any benefit resulting for such a greater transport velocity. In fact, Ryan teaches away from such a greater velocity. The transport velocity of the flowing gas is a result-effective variable and one having ordinary skill in the art has the skill to chose the value for such a variable that would determine the success of the desired reaction. As is pointed out in the Office Action, one of ordinary skill would choose the transport velocity to maximize "the length of time the flowing as mixture spends in a reaction zone where the mixture is exposed to the laser light and magnetic field for polarization, absent evidence to the contrary." (Office Action, page 7, lines 14-16.) There is no such evidence in Ryan.

Most importantly, the method described in Ryan would be significantly less efficient, if it worked at all, if the flowing mixture of gas had a transport velocity greater than the velocity of diffusive transport. In Ryan, if the xenon and nitrogen gas 40 had a transport velocity greater than that of diffusive transport, the xenon and nitrogen gas 40 would not diffusively mix with the rubidium gas 36a. As a result, there would be regions within the vessel 24 that are deficient in rubidium and, as a result, have no polarization interaction with the laser light.

The fact that the present invention flows gas faster than the velocity of diffusion allows it to operate as a single-pass sequential process, in which different stages in the polarization process happen at different locations in the polarizing apparatus and those locations (and polarization steps) are not revisited by the same sample of gas. For example, the gas mixture furthest from the laser has an equilibrium rubidium polarization and xenon polarization that is

low, because it is far from the laser and the light is attenuated. The gas mixture closer to the laser has a high xenon polarization and rubidium polarization. If the gas mixture were able to diffusively mix, the high polarization xenon would revisit the unilluminated end of the polarizing cell a second time and its polarization would drop.

Applicant respectfully submits that Ryan does not, and cannot, anticipate claim 1. Applicant further respectfully submits that claims 4 and 6, which are dependent on claim 1, are allowable as claims dependent on an allowable independent claim are also allowable.

**Rejections under 35 U.S.C. §103**

Claims 2-3 and 11-12 are rejected as being unpatentable over Ryan. Applicant respectfully traverses the rejections.

With respect to claim 2, the Office Action states:

> "...the shape of the polarizing cell disclosed by Ryan allows the flowing mixture of gas to freely fill the reaction vessel 24 throughout its cavity 24a (Fig. 2). Thus, some of the flowing gas would have been diverted along a direction generally opposite to the direction of laser light." (emphasis added) (Page 7, line 18 to p. 8, line 2).

In Ryan some of the flowing gas mixture may have been diverted briefly and accidentally, as there is no suggestion of any benefit therefrom, in a direction generally opposite the direction of the laser light. However, in Ryan, the overall flow of the gas mixture is perpendicular to the direction of laser light. Ryan states:

> "As a result of this combination of Rb gas from the source 36 and xenon gas from the inlet port 38 adjacent the lower extent of the cavity 24a and of outlet port 38 adjacent to the upper extent of this cavity 24a, an up-welling of these gases together occurs in the cavity 24a." (column 4, lines 6-10)

This upward flow of the gas mixture is perpendicular to the direction of the laser light as shown in Fig. 2 of Ryan.

Moreover, claim 5 of Ryan (column 7, lines 62-65) implies that the laser light is perpendicular to the "upwelling" gas flow. More importantly, claim 15 of Ryan (column 9, lines

9-13) goes even farther and expressly claims "a plane of laser light energy traversing said cavity generally perpendicularly to flow of said mixed and up-welling alkali metal and xenon gas in said cavity.

Claim 2 of the present invention which describes the gas mixture flowing "along a direction generally opposite to the direction of the laser light propagation" should be allowed. Nothing in Ryan suggests such a flow. Moreover, the fact that the flow of the gas mixture goes opposite to the laser light allows the gas to extract any remaining energy from the laser light when the gas mixture first enters the polarizing cell (in the low polarization region) and then move progressively towards the regions of the polarizing cell where the laser light is less attenuated and more intense, raising the polarization of the rubidium and xenon, and never revisiting the region of the cell with low polarization.

Applicant also respectfully submits that claim 2 is not obvious in view of Ryan and is allowable. Applicant also respectfully submits that claim 2, which is dependent on claim 1, is allowable as claims dependent on an allowable independent claim are also allowable.

With respect to claim 3, the Office Action states:

> "As to wherein the polarizing cell has a length substantially greater than the laser attenuation length, the length of the polarizing cell is a result-effective variable and one having ordinary skill in the art has the skill to calculate the polarizing cell that would determine the success of the desired reaction to occur, e.g., the length of the polarizing cell would have determined the length of time the flowing gas mixture spends in a reaction zone where the mixture is exposed to the laser light and magnetic field for polarization, absent evidence to the contrary." (Office Action, page 8, lines 3-9.)

This statement in the Office Action is incorrect. If the polarizing cell has a length substantially greater than the laser attenuation length, some portion of the cell is not "exposed to laser light...for polarization." Therefore, the length of time the flowing gas mixture spends in a reaction zone would not be increased to the extent the flowing gas mixture occupies the portion of the cell not exposed to laser light for polarization.

Thus, there is not a suggestion in Ryan, and it would not be obvious to one skilled in that to suggest, that the polarizing cell should be substantially longer than the laser attenuation length. In fact there is significant teaching that the polarizing cell should be shorter than the laser attenuation length.

All other polarization methods prior to that of the present invention rely on diffusively mixed cells and must adjust the level of rubidium and/or xenon in their polarizing cells so that rubidium even at the back of the polarizing cells becomes polarized to a level that is substantially similar to the rubidium at the front of the polarizing cell. This requires that the laser intensity at the back of the polarizing cell be substantially similar to that at the front of the polarizing cell. Consequently, most of the laser light is exhausted out the back of the polarizing cell. This has been a well known problem to those skilled in the art. If most of the laser light is utilized in the polarizing cell, then the rubidium at the back of the cell has much lower polarization than that at the front. This will cause the xenon polarization to approach only the average polarization in the polarizing cell.

Applicant respectfully submits that claim 3 is not obvious in view of Ryan and is allowable. Applicant also respectfully submits that claim 3, which is dependent on claim 1, is allowable as claims dependent on an allowable independent claim are also allowable.

With respect to claims 11 and 12, Applicant respectfully submits that claims 11 and 12, which are dependent on claim 1, are allowable as claims dependent on an allowable independent claim are also allowable.

**Allowable Subject Matter**

Claims 5, 7, 9 and 10 are allowable if rewritten 1) to overcome the rejection under 35 USC 112 and the objections cited above, and 2) to include all of the limitations of the respective base claims and any intervening claims. These claims have been rewritten to overcome the cited rejection and objections. Applicant respectfully submits that claim 1, upon which claims 5, 7, 9 and 10 are dependent, is now allowable, and claims 5, 7, 9 and 10, are allowable as claims dependent on an allowable independent claim.

Claim 8 is allowable if rewritten to include all of the limitations of the base claim and any intervening claims. Applicant submits that claim 1, upon which claim 8 is dependent, is now allowable, and claim 8 is allowable as a claim dependent on an allowable independent claim.

**Conclusion**

The claims have been shown to be allowable over the prior art. Applicant believes that this paper is responsive to each and every ground of rejection cited by the Examiner in the Office Action dated October 5, 2004, and respectfully requests favorable action in this Application. The Examiner is invited to telephone the undersigned, Applicant's attorney of record, to facilitate advancement of the present Application.

Applicant herewith petitions the Commissioner of Patents and Trademarks to extend the time for reply to the Office Action dated October 5, 2004 for one month. Please charge deposit account number 04-0932 (Reference Number 09815/47779), in the amount of $60.00 to cover the cost of the extension.. Any deficiency or overpayment should be charged or credited to the above numbered deposit account.

Respectfully submitted,

Date: 02-07-05

By: _____
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**Corrected Drawings**

Replacement drawing sheets, without markings are attached as Attachment A. The replacement drawings contain no new matter. Annotated drawing sheets showing the changes are attached as Attachment B. An explanation of the changes is included in the Remarks/Arguments section of this paper.

Attachment B Annotated Marked-up



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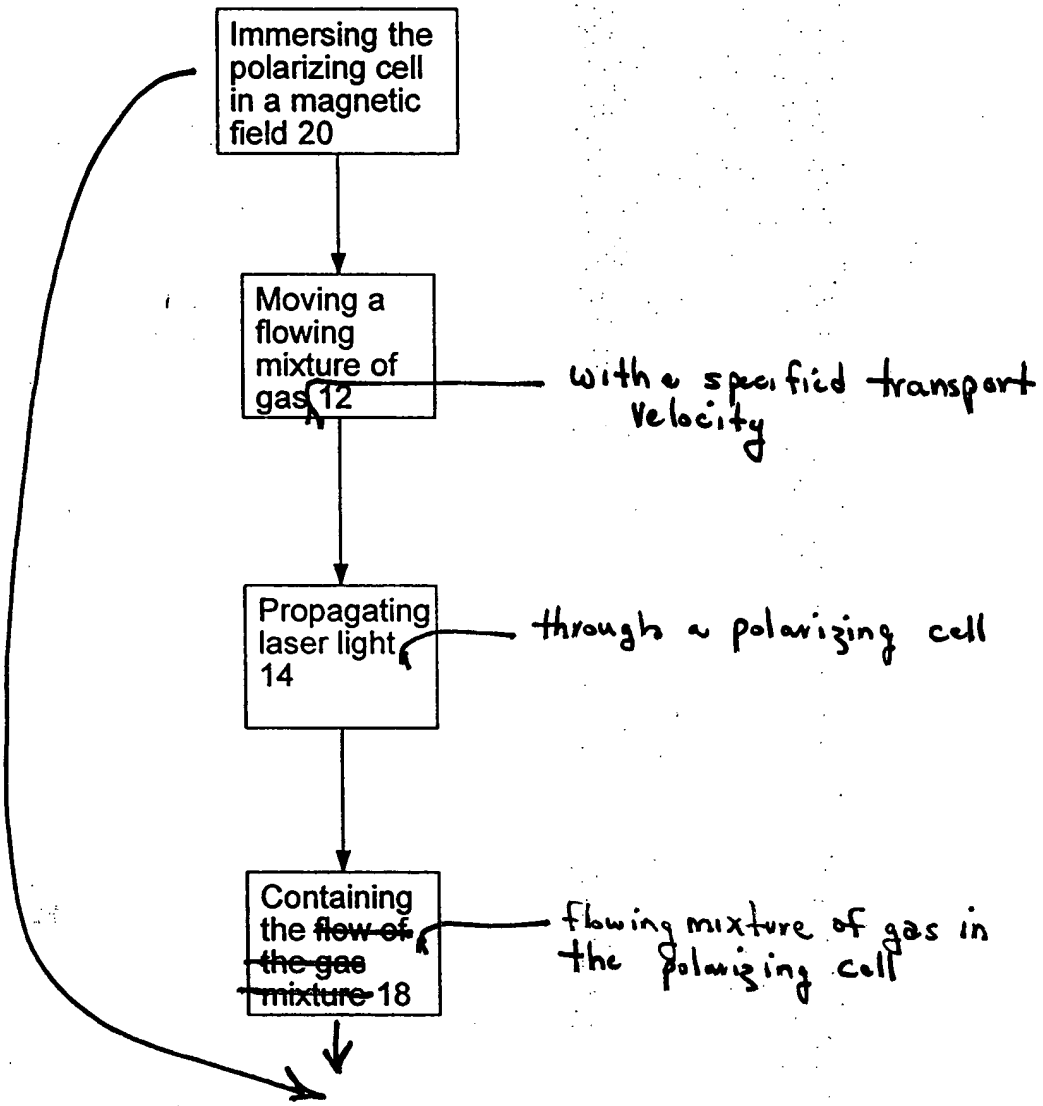


Figure 1

Annotated Marked-up

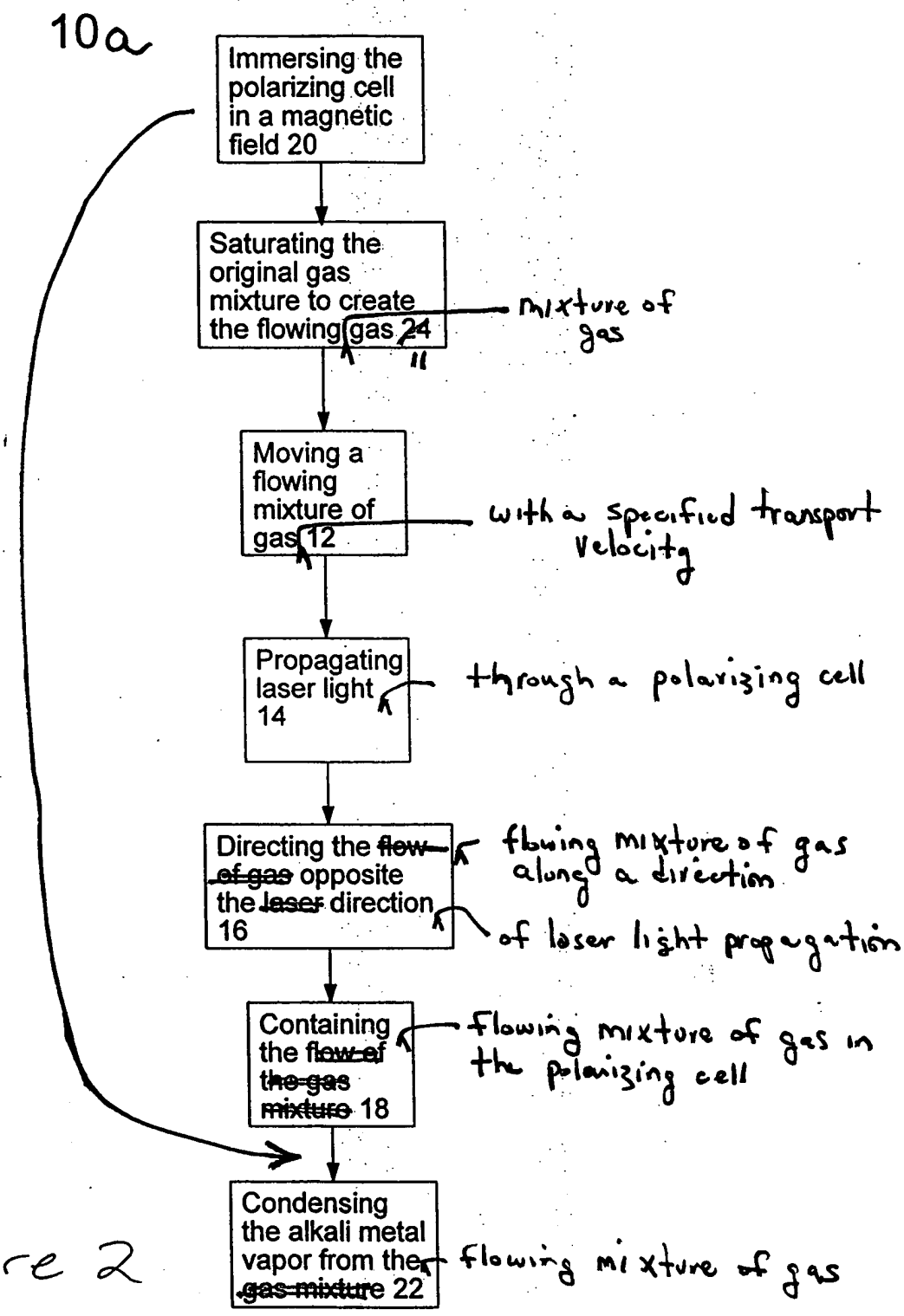


Figure 2

Annotated Marked-up

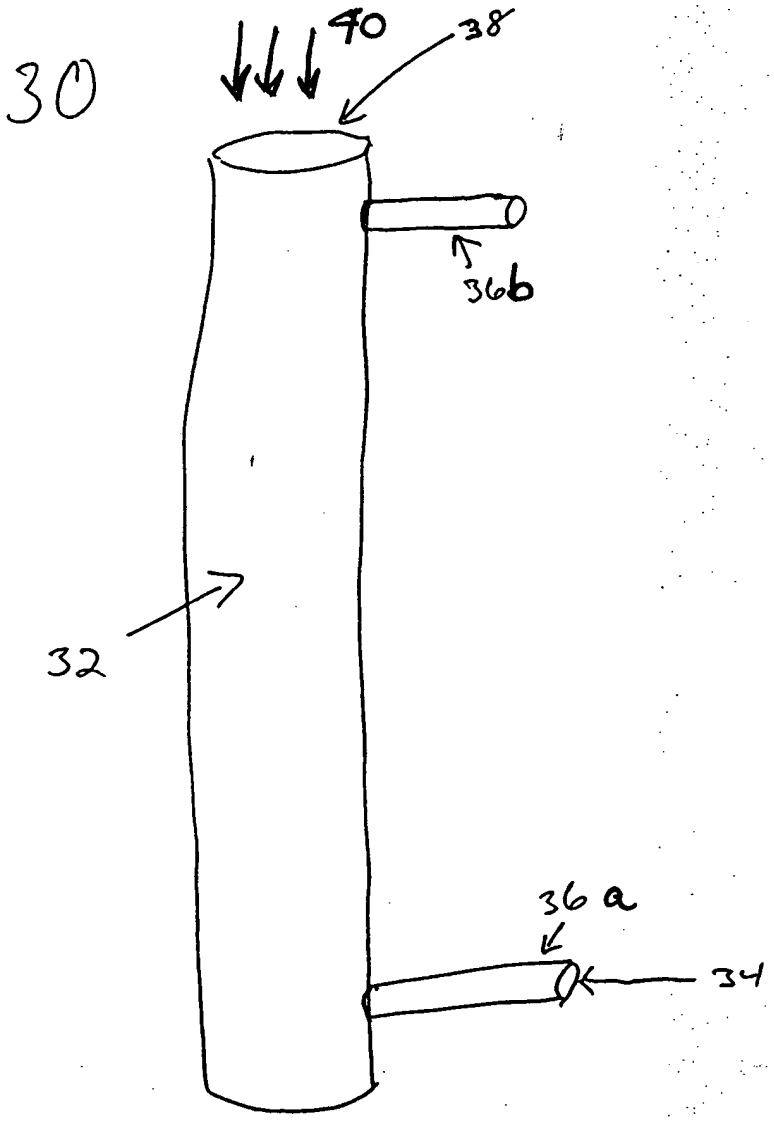


Figure 3

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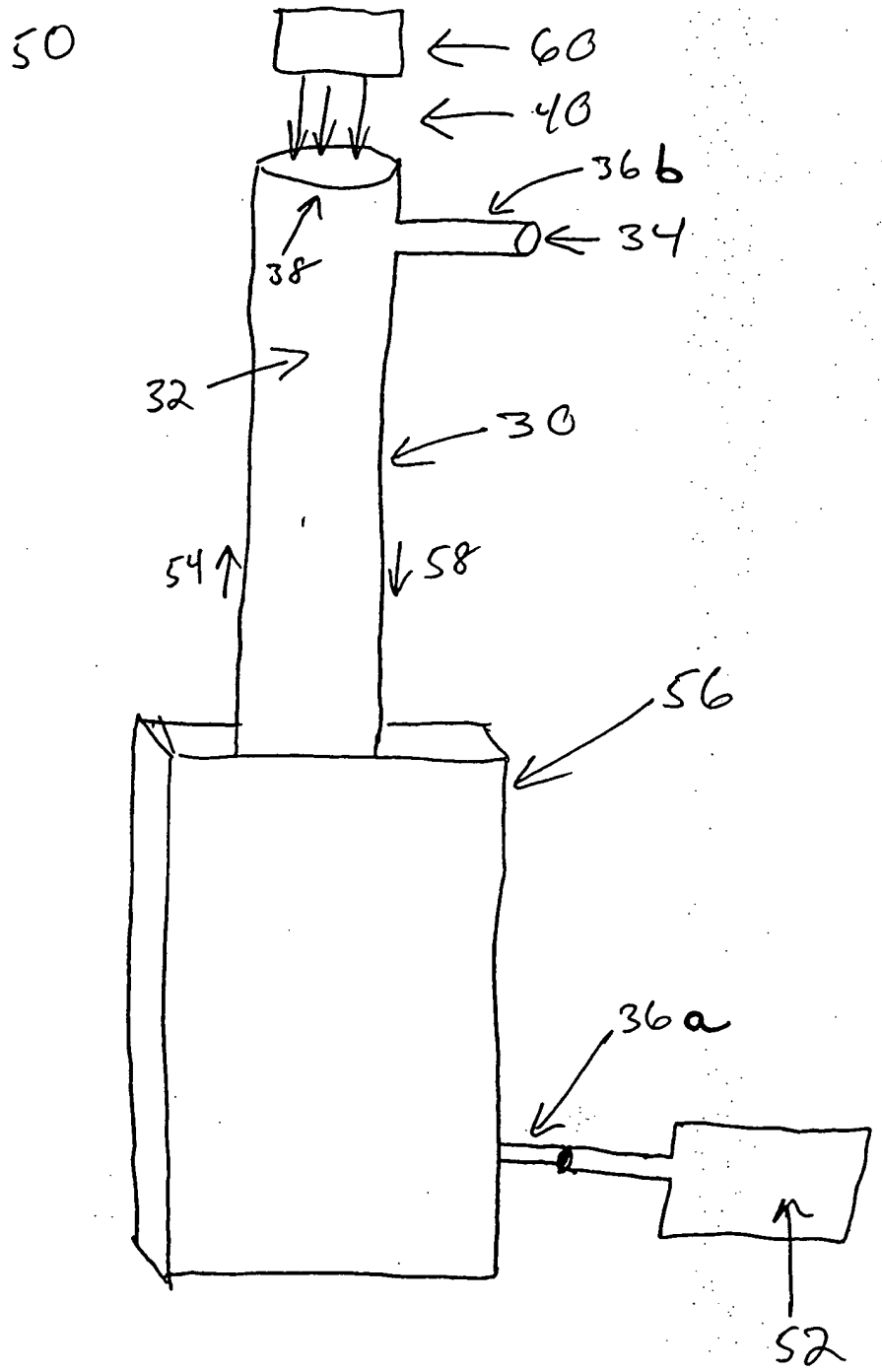


Figure 4

Annotated Marked-up

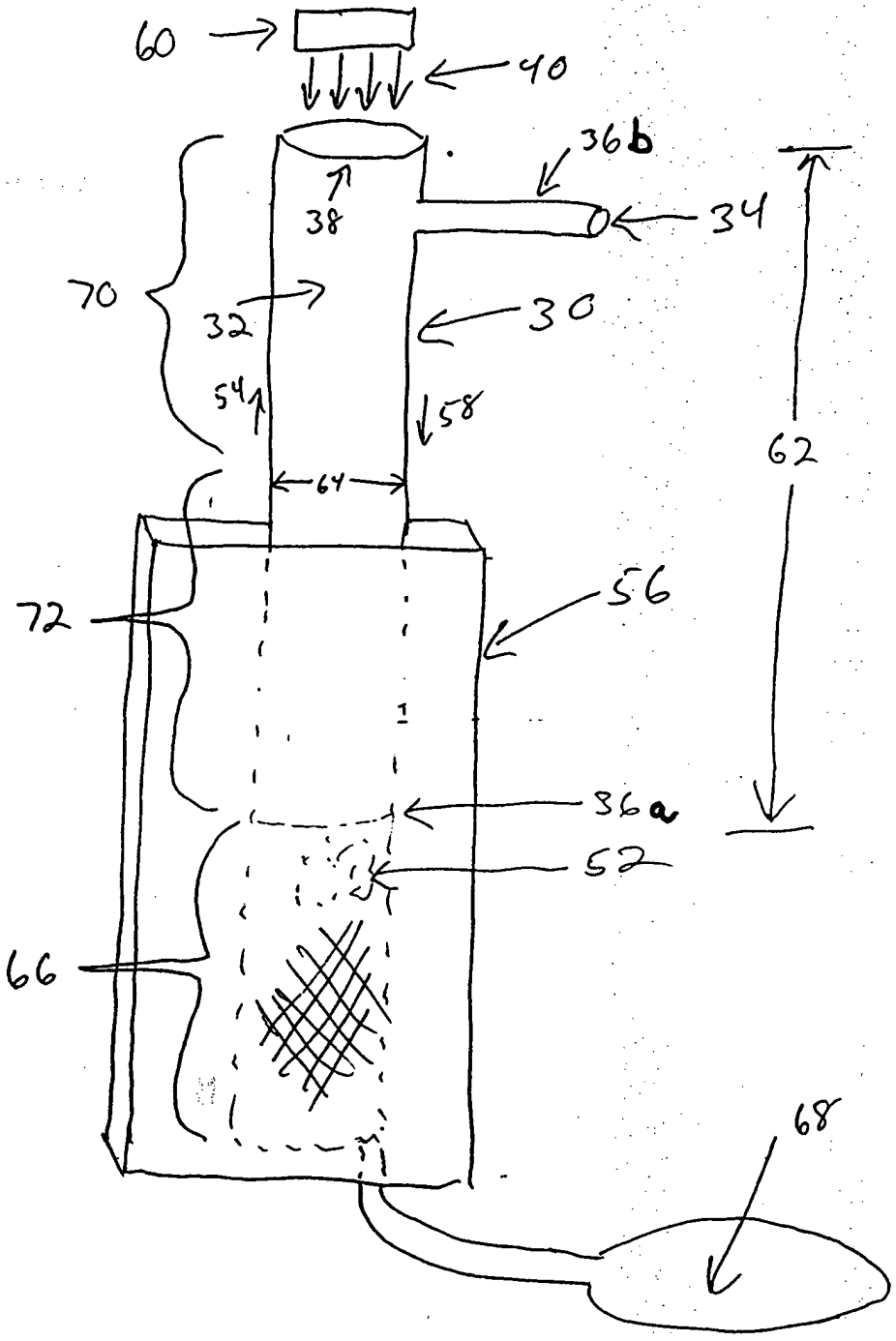


Figure 5

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Annotated Marked-up

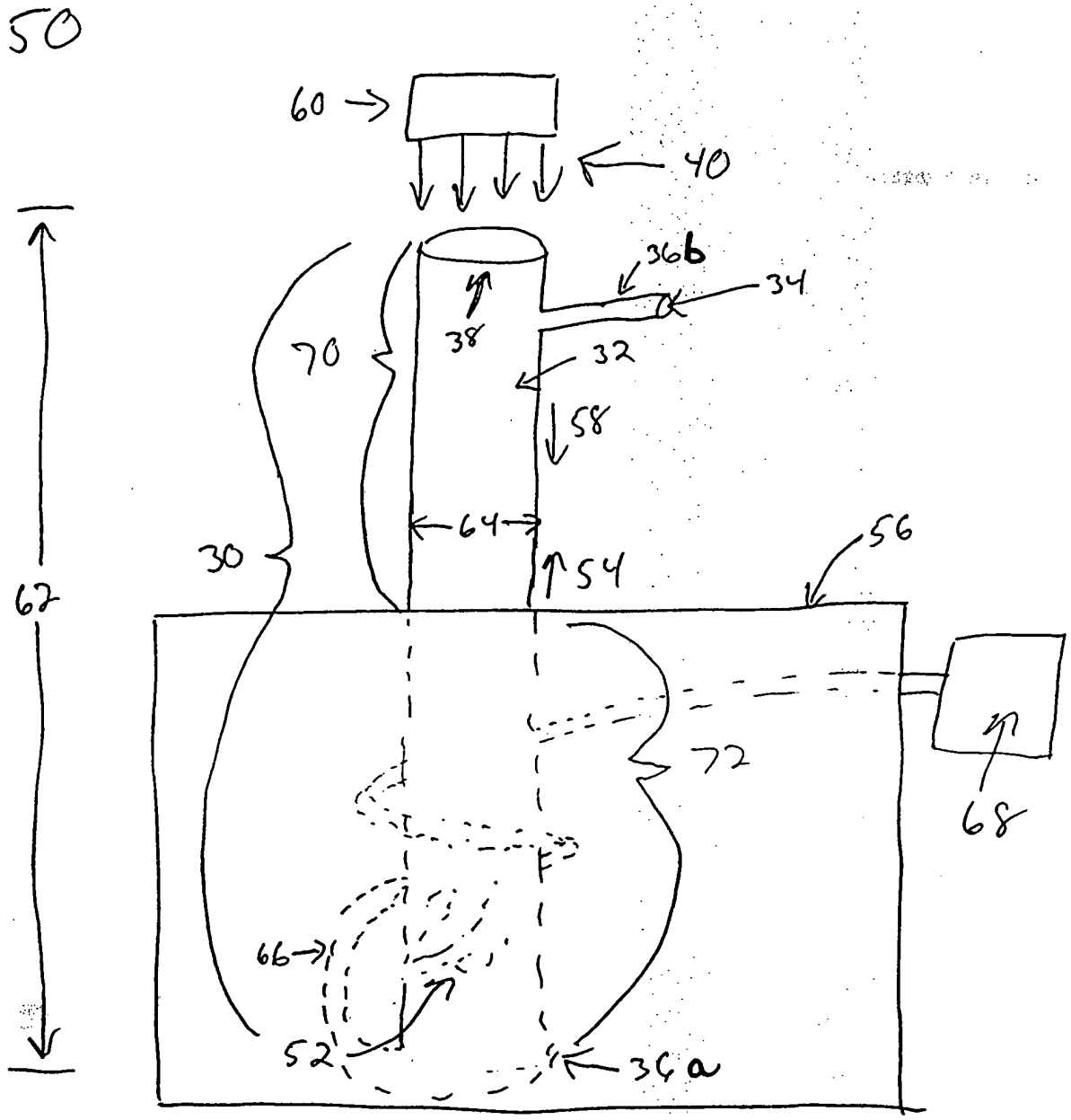


Figure 6

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